CLAIMS:

1. A method for reducing noise in a discrete pixel image, the method comprising the steps of:

(a) shrinking a first initial image and a second initial image by a given factor to produce a first shrunken image and a second shrunken image;

(b) determining a threshold for a parameter associated with the second shrunken image;

(c) determining one or more indicated regions of the second shrunken image in which the parameter exceeds the threshold;

(d) determining one or more selected regions in the first shrunken image which correspond in part with the one or more indicated regions of the second shrunken image;

(e) processing the first shrunken image to reduce image noise by selectively processing the one or more selected regions of the first shrunken image and differentially processing one or more non-selected regions of the first shrunken image such that a processed image results;

(f) expanding the processed image by the given factor to produce an expanded image; and

(g) blending the one or more selected regions in the expanded image with one or more corresponding regions of the first initial image.

2. The method of claim 1, comprising the further step of deriving the first initial image from a high energy image and a low energy image acquired from a dual energy x-ray system and where the second initial image is the high energy image.

3. The method of claim 1, comprising the further step of augmenting the size of the first initial image and the size of the second initial image.

4. The method of claim 3, wherein the step of augmenting is accomplished by padding the boundaries of both the first initial image and the second initial image.

5. The method of claim 4, wherein the step of padding is accomplished by mirroring the image data at the boundaries of the first initial image and of the second initial image.

6. The method of claim 1, wherein in step (b) the parameter is intensity and the threshold is an intensity based threshold.

7. The method of claim 6, wherein the intensity based threshold is obtained by multiplying the average intensity of the second shrunken image by a scaling factor.

8. The method of claim 1, wherein the step of shrinking is accomplished by a sub-sampling technique.

9. The method of claim 8, wherein the sub-sampling technique is pixel averaging.

10. The method of claim 9, wherein the pixel averaging is non-overlapping.

11. The method of claim 1, wherein the step of shrinking is accomplished by use of a boxcar filter.

12. The method of claim 1, wherein the given factor is multi-dimensional and each dimensional factor is greater than or equal to one.

13. The method of claim 1, wherein in step (d) the one or more selected regions are determined in part by a scaled threshold value associated with the first shrunken image.

14. The method of claim 13, wherein the scaled threshold value is computed based upon an initial threshold value and a scaling factor.

15. The method of claim 14, wherein the scaling factor is input by a user.

16. The method of claim 1, wherein in step (d) the one or more selected regions are determined in part by pixels having values below a second threshold value but above a third threshold value, and positioned adjacent to a pixel having a value at or above the second threshold value.

17. The method of claim 16, wherein the second threshold is based upon a scaling factor selected by a user.

18. The method of claim 1, wherein in step (e) the processing of selected regions includes smoothing pixels based upon a dominant orientation and an orientation orthogonal to the dominant orientation.

19. The method of claim 1, comprising the further step of smoothing image data contained in the first shrunken image prior to determining the one or more selected regions.

20. The method of claim 1, wherein in step (e) the processing of selected regions includes directional sharpening of pixels in the selected region having a value above a desired lower limit value.

21. The method of claim 20, wherein the process of sharpening includes comparing a sharpened pixel in the selected region to one or more thresholds and

limiting the value of the sharpened pixel to the threshold value where the sharpened pixel value exceeds the threshold value.

22. The method of claim 1, wherein the step of expanding is accomplished using an interpolation technique.

23. The method of claim 16, wherein the interpolation technique is cubic interpolation.

24. The method of claim 1, wherein in step (g) the blending of one or more selected regions includes blending of one region comprising the one or more selected regions of step (d) and one region comprising the one or more non-selected regions of step (d).

25. The method of claim 1, wherein in step (g) the blending of one or more selected regions with the one or more corresponding regions occurs in different proportions for different selected regions.

26. A method for reducing noise in a discrete pixel image, the method comprising the steps of:

(a) sub-sampling a first initial image containing image data representative of pixels of a reconstructed image and a second initial image containing related image data such that a first shrunken image and a second shrunken image result and such that both the first initial image and the second initial image are shrunk by a given factor to produce the first shrunken image and the second shrunken image;

(b) determining one or more first image threshold values based upon a first image parameter;

(c) determining one or more second image threshold values based upon a second image parameter;

(d) selecting one or more second image regions in which the second image parameter exceeds the one or more second image thresholds values;

(e) identifying one or more structural features from image data represented in the first shrunken image such that the structural features correspond to the one or more second image regions and such that the first image parameter exceeds the one or more first image threshold values;

(f) smoothing the structural features to enhance the dominant orientation of the structural features;

(g) smoothing non-structural region to enhance the homogenization of the non-structural region;

(h) sharpening the structural features to enhance the dominant orientation associated with the structural features;

(i) expanding the first shrunken image by the given factor such that an expanded image results which has the same dimensions as the first initial image; and

(j) blending a fraction of the expanded image with image data from the first initial image.

27. The method of claim 26, comprising the further step of deriving the first initial image from a high energy image and a low energy image acquired from a dual energy x-ray system and where the second initial image is the high energy image.

28. The method of claim 26, comprising the further step of augmenting the size of the first initial image and the size of the second initial image.

29. The method of claim 28, wherein the step of augmenting is accomplished by padding the boundaries of both the first initial image and the second initial image.

30. The method of claim 29, wherein the step of padding is accomplished by mirroring image data at the boundaries of the first initial image and of the second initial image.

31. The method of claim 26, wherein in step (c) the second image parameter is intensity and a second image threshold is an intensity based threshold.

32. The method of claim 31, wherein the intensity based threshold is obtained by multiplying the average intensity of the second shrunken image by a scaling factor.

33. The method of claim 26, wherein the step of sub-sampling is accomplished by pixel averaging.

34. The method of claim 33, wherein the pixel averaging is non-overlapping.

35. The method of claim 26, wherein the step of sub-sampling is accomplished by use of a boxcar filter.

36. The method of claim 26, wherein the given factor is multi-dimensional and each dimensional factor is greater than or equal to one.

37. The method of claim 26, wherein the one or more first image threshold values comprise at least one scaled threshold value.

38. The method of claim 37, wherein the scaled threshold value is computed based upon an initial threshold value and a scaling factor.

39. The method of claim 26, wherein in step (e) the one or more first image threshold values comprise a first threshold value and a second threshold value and such that the structural features comprise pixels having values below the first threshold value but above the second threshold value, and positioned adjacent to a pixel having a value at or above the first threshold value.

40. The method of claim 39, wherein the first threshold value is based upon a scaling factor selected by a user.

41. The method of claim 26, wherein in step (f) the smoothing of structural features to enhance their dominant orientation includes smoothing pixels based upon a dominant orientation and an orientation orthogonal to the dominant orientation.

42. The method of claim 26, comprising the further step of smoothing image data contained in the first shrunken image prior to identifying the structural features.

43. The method of claim 26, wherein in step (h) the sharpening of structural features to enhance their dominant orientation includes the sharpening of pixels in the structural features having a value above a desired lower limit value.

44. The method of claim 43, wherein the process of sharpening includes comparing a sharpened pixel in the structural features to one or more thresholds and limiting the value of the sharpened pixel to the threshold value where the sharpened pixel value exceeds the threshold value.

45. The method of claim 26, wherein the step of expanding is accomplished using an interpolation technique.

46. The method of claim 45, wherein the interpolation technique is cubic interpolation.

47. The method of claim 26, wherein in step (j) the fraction comprises two or more portions such that the two or more portions are blended in different proportions.

48. The method of claim 47, wherein one portion comprises the structural features and one portion comprises the non-structural region.

49. A system for reducing noise in a discrete pixel image, the system comprising:

an output device for producing a reconstructed image based upon processed image data; and

a signal processing circuit configured to provide processed image data by sub-sampling image data representative of pixels of a first initial image and of a second initial image to produce a first shrunken image and a second shrunken image, identifying one or more selected regions of the first shrunken image using the second shrunken image and one or more selection criteria, processing the selected regions and the non-selected regions in different manners to create a processed image, expanding the processed image to the same dimensions as the initial image, and blending a fraction of the expanded image data with the initial image data to form a final image.

50. The system of claim 49, further comprising an image data acquisition system for producing image data signals processed by the signal processing circuit.

51. The system of claim 50, wherein the image data acquisition system comprises a dual energy X-ray scanner.

52. The system of claim 49, wherein the selected region is determined based upon a first scaled threshold value.

53. The system of claim 52, wherein the first scaled threshold value is computed based upon an initial threshold value and a scaling factor input by a user.

54. The system of claim 49, wherein the selected region comprises pixels having values below a first threshold value but above a second threshold value, and positioned adjacent to a pixel having a value at or above the first threshold value.

55. The system of claim 49, wherein the sub-sampling is accomplished by pixel averaging.

56. The system of claim 55, wherein the pixel averaging is non-overlapping.

57. The system of claim 49, wherein the step of sub-sampling is accomplished by use of a boxcar filter.

58. The system of claim 49, wherein the sub-sampling factor by which the first initial image and the second initial image are shrunk is multi-dimensional and each dimensional factor is greater than or equal to one.

59. The system of claim 49, wherein the step of expanding is accomplished using an interpolation technique.

60. The system of claim 59, wherein the interpolation technique is cubic interpolation.

61. The system of claim 49, wherein the fraction of the expanded image data comprises two or more portions such that the two or more portions are blended in different proportions.

62. The system of claim 61, wherein one portion comprises the selected regions and one portion comprises the non-selected regions.

63. The system of claim 49, wherein the signal processing circuit is also configured to augment the size of the first initial image and the size of the second initial image.

64. The system of claim 63, wherein the augmentation is accomplished by padding the boundaries of both the first initial image and the second initial image.

65. The system of claim 64, wherein the padding is accomplished by mirroring the image data at the boundaries of the first initial image and of the second initial image.

66. The system of claim 49, wherein the signal processing circuit determines an intensity based threshold for the second shrunken figure.

67. The system of claim 66, wherein the intensity based threshold is obtained by multiplying the average intensity of the second shrunken image by a scaling factor.

68. A system for reducing noise in a discrete pixel image, the system comprising:

an output device for producing a reconstructed image based upon processed image data; and

a signal processing circuit configured to provide processed image data by sub-sampling image data representative of pixels of a first initial image and of a second initial image to produce a first shrunken image and a second shrunken image, smoothing image data representative of pixels of the first shrunken image, identifying one or more structural features from the smoothed image data using image data from both the first shrunken image and the second shrunken image, orientation smoothing the structural features, homogenization smoothing non-structural regions, orientation sharpening the structural features, expanding the first shrunken image to the same dimensions as the first initial image to form an expanded image, and blending of first initial image data into the expanded image data to form a final image.

69. The system of claim 68, further comprising an image data acquisition system for producing image data signals processed by the signal processing circuit.

70. The system of claim 69, wherein the image data acquisition system includes a dual energy X-ray scanner.

71. The system of claim 68, wherein the structural features are determined based upon a first scaled threshold value.

72. The system of claim 71, wherein the first scaled threshold value is computed based upon an initial threshold value and a scaling factor input by a user.

73. The system of claim 68, wherein the structural features comprise pixels having values below a first threshold value but above a second threshold value, and positioned adjacent to a pixel having a value at or above the first threshold value.

74. The system of claim 68, wherein the orientation smoothing is based upon a dominant orientation and an orientation orthogonal to the dominant orientation.

75. The system of claim 68, wherein orientation smoothing is performed based upon a predetermined relationship between a characteristic of each structural pixel in the dominant orientation and in the orthogonal orientation.

76. The system of claim 75, wherein the characteristic is a number of counts of orientations within a neighborhood of each structural pixel.

77. The system of claim 68, wherein the sharpening is performed only for structural pixels having a value above a desired lower limit value.

78. The system of claim 68, wherein the sub-sampling is accomplished by pixel averaging.

79. The system of claim 77, wherein the pixel averaging is non-overlapping.

80. The system of claim 68, wherein the step of sub-sampling is accomplished by use of a boxcar filter.

81. The system of claim 68, wherein the sub-sampling factor by which the first initial image and the second initial image are shrunk is multi-dimensional and each dimensional factor is greater than or equal to one.

82. The system of claim 68, wherein the step of expanding is accomplished using an interpolation technique.

83. The system of claim 82, wherein the interpolation technique is cubic interpolation.

84. The method of claim 68, wherein the final image data comprises two or more portions such that the two or more portions are blended in different proportions.

85. The method of claim 84, wherein one portion comprises the structural features and one portion comprises the non-structural region.

86. The system of claim 68, wherein the signal processing circuit is also configured to augment the size of the first initial image and the size of the second initial image.

87. The system of claim 86, wherein the augmentation is accomplished by padding the boundaries of both the first initial image and the second initial image.

88. The system of claim 87, wherein the padding is accomplished by mirroring the image data at the boundaries of the first initial image and of the second initial image.

89. The system of claim 68, wherein the signal processing circuit determines an intensity based threshold for the second shrunken figure and where the intensity based threshold is a factor in identifying the one or more structural features.

90. The system of claim 89, wherein the intensity based threshold is obtained by multiplying the average intensity of the second shrunken image by a scaling factor.